DOCUMENT RESUME

ED 074 747 EM 010 933

AUTHOR Ash, Michael J.; Sattler, Howard E.
TITLE A Video Tape Technique for Assessing Behavioral Correlates of Academic Performance.
PUB DATE Mar 73
NOTE 18p.; Paper presented at the American Educational Research Association Annual Meeting (New Orleans, Louisiana, February 25-March 1, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Academic Performance; Attention Control; *Classroom Observation Techniques; Elementary School Mathematics; Evaluation Techniques; Motivation; Observation; *Performance Factors; *Timed Tests; *Video Tape Recordings
IDENTIFIERS *Arizona

ABSTRACT

The relation between videotape-based observer judgements of attention to task and paper-and-pencil measures of academic performance was investigated in this study. Forty-five Grade 4 pupils engaged in an arithmetic computation task and were video-taped for ten consecutive school days. The tapes were then independently viewed by three observers, and pupils were rated on their observable attention to task. Significant correlations on the order of .50 (p less than .01) were obtained between attention to task ratings and academic performance. An intraclass correlation of .93 was obtained as an estimate of inter-observer reliability. The data supported the use of indirect observational methods in assessing school performance. (Author/MC)

A VIDEO TAPE TECHNIQUE FOR ASSESSING BEHAVIORAL CORRELATES OF ACADEMIC PERFORMANCE

Michael J. Ash and Howard E. Sattler

Arizona State University

Paper read at the American Educational Research Association Meeting, New Orleans, Louisiana, February 1973.

Abstract

The relation between video tape based observer judgments of attention to task and paper and pencil measures of academic performance was investigated. Forty-five fourth-grade pupils engaged in an arithmetic computation task were video taped for ten consecutive school days. Tapes were independently viewed by three observers and pupils were rated on attention to task. Significant correlations on the order of .50 ($p < .01$) were obtained between attention to task ratings and academic performance. An intraclass correlation of .93 was obtained as an estimate of inter-observer reliability. Data supports the use of indirect observational methods in assessing school performance.

During recent years the assessment of pupil performance has come to occupy a central position among efforts directed at the improvement of educational practice. Schemes that have emerged for assessing student performance classify as either (a) direct measures of school performance, e.g., the continuous measure of pupil response rate (Gassholt, 1970; Lovitt & Curtiss, 1969) or (b) indirect measures of academic performance, e.g., the degree to which pupils are observed attending to task (Attwell, Orpet, & Meyers, 1967; Ferritor, Buckholdt, Hamblin, & Smith, 1971; Hall, Lund, & Jackson, 1968). However, advantages and disadvantages accrue to each approach.

It is true that direct measures are sensitive to ongoing changes in pupil performance and that such measures have the added benefit of providing students with immediate feedback. Yet direct measurement procedures can present real hardships for teachers in the form of logistical problems. Since the educational setting typically provides the teacher with a multitude of tasks, it is often difficult for her to see the relative merit in maintaining a comprehensive system of continuous measurement. Such plans are therefore often discarded after an enthusiastic but brief trial period.

Indirect schemes for measuring pupil performance relieve the teacher of some time constraints imposed by research. Often trained observers located in the classroom handle the recording of both teacher and pupil behavior and no special modification of class schedule is required. The procedure typically involves an observer selecting a target behavior and recording the frequency of occurrence of that behavior through a time-sampling process. The observer is, however, severely restricted in the number and kind of behaviors that can be counted. Further, since observers do not always agree, most observational arrangements necessitate the presence of a second observer so that an index of inter-observer agreement can be obtained. The approach is generally restricted to the recording of small "bits" of pupil behavior, since it is difficult to obtain observer agreement on more complex behavioral sequences. Perhaps the most damaging criticism of the "observer present" technique is the concern over the lack of evidence involving the validity of the measures obtained. The inference that attention to task behaviors are accompanied by a corresponding increase in academic performance has received only limited attention.

Recently, however, modern technology has provided techniques such as time lapse photography, motion pictures, and video tape recording that offer advantages over the indirect procedure of maintaining trained observers in the classroom. Flanders (1967), for example, has used audio tapes to train observers, and a major attempt has been made to record and translate the entire spectrum of teacher-pupil interaction via video tape (Adams & Biddle, 1970). By using video tape equipment, it is a relatively simple task to record individual or group rates of "attention to task," and overcome most of the limitations imposed on observers in the classroom.

The present study was undertaken to investigate two problems of indirectly measuring and evaluating pupil performance using a video tape recording device. First, to evaluate the efficacy of a stop-action video tape technique for reliably measuring ongoing behavioral events, in particular, the extent to which groups of pupils attend to task in a regular classroom. Second, to determine the degree to which measures of attention to task recorded on video tape were correlated with paper and pencil measures of the quality and quantity of academic performance simultaneously obtained during taping sessions. Such a determination examined the relation between indirect measures of performance and actual academic output.

Method

Subjects

Forty-five fourth-grade pupils, 25 males and 20 females, from Hudson Elementary School, Tempe, Arizona, served as subjects in the stud The most recent Stanford Achievement Series--Arithmeti Computation subtest scores were obtained for each S with the exception of one. Arithmetic computation ability for that S was estimated by her teacher (T). Subtest scores were reported in the form of grade level equivalents and were used to estimate the current level of arithmetic computation ability for each S. Scores for Ss on this achievement computation measure ranged from 4.6 to 2.2 with a mean of 3.47. Pupils were selected as Ss for this study on the bases of whether their desks were included in the optimal camera angle for each area, and whether they had obtained parental permission to be video taped.

Apparatus

A Sony AV-3400 portable record/playback videorecorder having a stop-action capability and a Sony AVC-3400 video camera equipped with a Soligor f/1.8 wide angle lens was used to record and play back observation sessions. A tone pulse system was used to record an audio tone of one-second duration at 30-second intervals on the video tape sound track. This system consisted of a rotary-cam microswitch pulse generator connected to a DC relay.* Every 30 seconds the pulse generator provided a one-second flow of AC current to the DC relay producing a distinct buzz. The system was isolated with a low impedence microphone in a ten-inch by five-inch box, so that the buzz could not be heard by Ss during taping sessions. Another low impedence microphone was used to record normal classroom noise level. Both microphones were connected to a Shure microphone mixer, which allowed the classroom noise and the buzz signal to be recorded simultaneously on the video tape sound track.

The videorecorder, tone generating system, microphone mixer, and a Sony recorder and camera powerpack were mounted on a small wheeled cart equipped with a two-plug extension cord. Thus, power for all components was provided by energizing a single-line cord. The equipment was arranged so that the pulse generator could be activated independently from other components. The video camera was mounted on a standard tripod and the entire system was easily moved to different locations in the classroom.

---

*Appreciation is extended to Ronald D. Zellner for the development of the tone pulse system used in this study.

Procedure

The observational setting consisted of a large open classroom containing 125 pupils grouped in four seating areas of approximately 31 pupils each. For taping and identification purposes these areas were numbered Area 1, Area 2, Area 3, and Area 4. Twelve Ss were taped in Area 1, 13 in Area 2, and 10 each in Areas 3 and 4. In all, 45 pupils were video taped and served as Ss in the study. During the afternoon the pupils were normally seated in heterogeneous ability groups, and the arrangement was not disturbed for taping sessions.

Taping sessions consisted of 10-minute arithmetic seatwork sessions. Each pupil in the entire area was given an identical worksheet of 80 arithmetic problems that were taken at random from the T's handbook (Eichology, O'Daffer, Brumfiel, & Shanks, 1964). Types of problems included 2-, 3-, and 4-digit addition, subtraction, multiplication, and division problems. T accompanied her distribution of seatwork materials by saying: "It is time for an arithmetic practice session; please put your name and the date at the top of the page. Don't begin work until I ask you to do so."

When the teacher told the pupils to begin work, E started the video camera, stopwatch, and pulse generator simultaneously. Thus, the initial buzz on the tape sound track occurred 30 seconds after Ss had begun work. This insured that 20 buzzer tones would be recorded on the sound track during the 10-minute session. At the end of the 10-minute period, E signalled the teacher to have the pupils stop work, and simultaneously turned off the video camera. The arithmetic materials were collected and E moved to the next area.

This procedure was repeated with each of the four classroom groups. Ten different work sheets containing equivalent arithmetic computation problems were used over the ten-day taping period. Each day 125 pupils in the room engaged in the same arithmetic material for a 10-minute period, and the 45 pupils who were seated within camera range served as Ss in the study.

Data Recording

Two kinds of behavioral measures, (a) attention to task, and (b) academic performance, were used to assess the merits of the video tape technique and the relation between the two measures. The academic performance data for each S took two forms: (a) total number of problems completed, and (b) total number of problems completed correctly. Work performed by Ss during taping sessions was hand scored for these two performance measures. Data on the attention to task measure were taken from the video tapes by three trained observers (Os).

Three graduate students were trained as Os in a single 45-minute training session. The Os were told that they were going to view tapes of children working in a classroom, and that their job was to judge whether the pupils were attending or not attending to task at the end of 30-second intervals. The following definition of attention to task behavior was then given to Os: Whenever the child is fully seated at his desk, looking at his paper, and holding his pencil in his hand, he is considered to be attending to task. Any negation of these criteria such as looking or walking around the room, or not holding the pencil will be considered non-attention.

Os were provided data recording sheets corresponding to seating charts of the areas that were taped. The data sheets for the four different areas showed only seating position of Ss, no names were given. Using the data sheets as a guide, Os were shown a short video tape of each area in order to orient them to Ss' seating arrangements.

After Os indicated they could relate the tapes to the data sheets, they were given instructions regarding actual observation procedures as follows:

> After you have threaded the tape, place the control lever in the 'forward' position. At the end of a 30-second interval you will hear a distinct buzz. At that time place the still mode control lever in the 'still' position. This will freeze the picture and allow you to judge each child appearing on your

> data sheet for each area. At each judgment interval record either an 'X' indicating attention to task behavior or an 'O' indicating a non-attention to task behavior for each child. After you have recorded your judgments, return the still mode lever to the 'off' position and the picture will begin moving again. Are there any questions? Remember, there will be 20 buzzer tones heard during each 10-minute session, so you should stop the tape 20 times and make 20 judgments on each child.

Following a careful reading of the instructions, Os were given approximately 10 minutes of training on operating the videorecorder. When each O expressed condifence in the observation procedures, the training session ended.

Results

In order to determine the reliability of the video tape technique for classroom observation, an intraclass correlation coefficient was computed. The coefficient was obtained by summing the number of "on task" judgments made by each observer on all Ss and using these sums in the computation of the coefficient. The intraclass index for the three Os engaged in the study was .93 indicating a high degree of reliability among observer ratings of pupil attending behaviors.

To examine the relationship between observer ratings and academic performance, an arithmetic average was taken on the total number of on-task judgments made by the three Os for each S over the 10-day period. These mean values were then correlated with the 10-day sum, for each S, on the following three measures: (a) total number of problems completed, (b) total number of problems correct, and (c) grade level equivalent on the Stanford Achievement Test Arithmetic Computation subtest. The correlation matrix for these four variables is shown in Table 1.

TABLE 1

Correlation Matrix of the Four Relevant

Variables for All 45 Ss

	1	2	3	4
1 Total problems completed	1.000			
2 Total problems correct	0.8125	1.000		
3 Observer ratings	0.5107	0.4881	1.000	
4 Stanford Achievement scores	0.2551	0.5383	0.2060	1.000

The values in Table 1 represent the obtained intercorrelations of the four variables under consideration for all 45 Ss. It is noteworthy that while Stanford Achievement scores and O ratings have similar correlations with problems correct, O ratings exhibit a much stronger association with the quantity of work completed.

Arithmetic computation ability logically accounts for a portion of the association between academic performance measures and attention to task ratings, and since this effect would confound the association between performance and attention with another factor, i.e., arithmetic ability, these effects were held constant by applying the partial correlation technique to the data used in computing the intercorrelation matrix illustrated in Table 1. The correlation between total problems completed and attention to task, with ability partialled out was .4843 (as compared to the regular Pearson r of .5107).

The partial correlation for total correct problems and attention to task was .4576 (Pearson r = .4881). These partial correlation coefficients were significantly different from zero ($p < .01$).

To determine the effect of differential arithmetic computation ability on the association between academic performance and attention to task, arithmetic computation scores were used to divide Ss into high (grade level equivalent of 4.0 and above), average (3.00 to 3.99), and low (2.99 and below) ability groups. The correlation matrices for this analysis are presented in Table 2.

It should be noted that the Stanford Achievement scores have been excluded from the analysis in Table 2 because these scores were the basis for the formation of the ability groups. The correlations between the measures of academic performance and attention to task were highest for the high ability group (.5592 and .4759), and progressively lower for the other groups (.4941 and .4628 for the average group and .3254 and .4316 for the low group). However, only the values for the average group were significantly different from zero ($p < .01$), perhaps due to the small sample size of the high and low groups. Also, it is of interest that the correlation between the number of problems completed and the number of problems correct was .9927 for the high group, .7693 for the average group, and .7287 for the low group.

Finally, to ascertain the effect of sex differences, all 45 Ss were dichotomized into male and female groups. The correlation matrices for all four variables, i.e., both academic performance measures, O ratings of attention to task, and Stanford Achievement scores, are shown for these two groups in Table 3.

An examination of the values in Table 3 reveals that the correlations between the two academic performance measures and attention ratings were slightly higher for females than for males. When the effect of arithmetic computation ability was partialled out, the correlations between total problems completed and problems correct with ratings of attention were

TABLE 2

Correlation Matrices for <u>High</u>, <u>Average</u>, and <u>Low</u> Ability Groups

Between the Variables of Total Problems Completed, Problems

Correct, and Observer Ratings of Attention to Task

	High Ability Group			Average Ability Group			Low Ability Group		
	1	2	3	1	2	3	1	2	3
1 Total problems completed	1.0000			1.0000			1.0000		
2 Total problems correct	0.9927	1.0000		0.7698	1.0000		0.7287	1.0000	
3 Observer ratings	0.5592	0.4759	1.0000	0.4941	0.4628	1.0000	0.3254	0.4316	1.0000

TABLE 3

Correlation Matrices for All Four Variables for Male and Female Groups

	Male Group				Female Group			
	1	2	3	4	1	2	3	4
1 Total problems completed	1.0000				1.0000			
2 Total problems correct	0.9013	1.0000			0.7136	1.0000		
3 Observer ratings	0.4817	0.4363	1.0000		0.5249	0.6017	1.0000	
4 Stanford Achievement scores	0.3749	0.6083	0.0547	1.0000	0.0785	0.3810	0.4552	1.0000

.4982 and .5086 respectively for the male group. The partial correlations for the female group were .5724 between problems completed and attention, and .5203 between problems accurate and attention. The partial correlations for the male group were significantly different from zero ($p < .01$) as were those for the female group ($p < .05$). No significant difference between groups ($p > .25$) was found using Fisher's transformation to z (Guilford, 1965).

In order to show differences in magnitude and variability between all groups in the analysis of all four variables, the means and standard deviations of the four variables are shown in Table 4.

Of special interest in Table 4 are the mean differences on all four variables between the three groups (high, average and low). In general, the mean values followed a trend from highest magnitude in the high group, somewhat less for the average group, and least for the low group. The only exception occurred with the O rating variable between the high and average group. These values were nearly identical for both groups (high group = 159.14, average group = 161.57).

Discussion

One of the major purposes of this study was to determine the empirical relationship between indirect measures of academic performance, i.e., attention to task behavior, and actual academic output. The data indicate that such indirect measures are significantly related to both the quantity and quality of school performance. Thus, these findings confirm those of Cobb (1972) and Lahaderne (1968).

The results were also of practical significance to those investigators who use indirect measures of academic performance as dependent variables in experimental research. As a result of the data obtained in this study and by others (Cobb, 1972; Lahaderne, 1968), the inference that attention to task behaviors are related to academic performance is strengthened. In fact,

TABLE 4

Means and Standard Deviations of All Variables for All Groups

	All Ss N=45		High Group N=7		Average Group N=28		Low Group N=10		Male Group N=25		Female Group N=20	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Total problems completed	347.27	127.27	384.57	122.48	367.57	130.38	264.30	90.42	333.76	122.48	364.15	134.24
Total problems correct	267.49	115.66	355.00	108.48	284.39	107.53	158.90	63.41	261.72	131.66	274.70	97.56
Observer ratings	157.82	22.41	159.14	21.87	161.57	20.99	146.40	24.95	152.44	22.16	164.55	21.37
Stanford Achievement scores	3.47	0.62	4.29	0.18	3.59	0.28	2.54	0.22	3.45	0.69	3.50	0.54

in this study, the attention to task measure accounted for more of the variance in one of the academic performance measures (total problems completed) than did the pupil's achievement test scores in arithmetic computation (approximately 25% versus approximately 6%), and accounted for nearly the same amount of variance in the total problems correct variable (approximately 23% versus approximately 28%). This was probably due to the fact that quality of work reflected primarily an ability factor, while quantity reflected more of a motivational component. Thus, it was not surprising that Stanford Achievement scores were more strongly associated with quality than with quantity. What was important was that attention ratings were nearly as related to quality as the Stanford scores, and much more related to quantity.

Several other of the obtained correlations were also of interest. The entire group of Ss was divided into three subgroups based on amount of arithmetic computation ability. This was done to see whether bright children needed to attend as much to perform the same amount of work as less able pupils. The results were equivocal. While the correlations for the high ability group were highest for attention to task, problems completed, and problems correct of the three ability groups, the average group obtained a higher mean number of attention to task ratings (161.57 versus 159.14) yet performed at a lower rate both quantitatively and qualitatively. The finding is an interesting one and needs to be investigated experimentally. One possible interpretation is that "bright" children do not need to attend more than other children to produce the academic output expected of them.

Since sex differences in school performance seem to occur with regularity, Ss were divided into male and female groups to determine if such differences were present. In general, it has been found that male pupils have relatively greater difficulty in school, both academically and socially (Kagan, 1971). Since the variables recorded in this study involved both academic and social behaviors, it seemed plausible that the association would be different for boys than for girls. Although the female group had a higher rate of absolute performance than the male group, the association between the relevant variables was nearly identical for both sexes.

Efficacy of the video tape technique. The use of video tape recordings of pupil behaviors in itself does not offer anything new to scientific investigation. Audio tapes, still cameras, and motion pictures have been used quite often as investigatory tools. In this study, however, video tape recordings were used as a vehicle to improve the reliability and validity of more standard "observer present" time-sampling techniques.

With the standard time-sampling technique, several observers record the behavior of children one at a time at prespecified intervals. Thus, observers are recording the behaviors of different children at different times. Through the use of video tapes, and their "still" mode function, each observer rates the same behavior of the same pupil at the same time. Hence, not only are the reliability and validity of the observers' judgments improved, but the length of the time interval is more flexible. For example, it would be nearly impossible for an observer using a standard time-sampling procedure to record the behavior of a classroom of pupils every five seconds. Using the video tape technique, however, the problem is reduced.

In addition, video tapes are a permanent record of behavior, and as such permit flexibility in data analysis. Post hoc analyses can be applied to determine the context of the behavioral variables being rated, to determine if important sequencing effects have been overlooked, or to analyze yet another set of variables from the same tape. Further, since each observer is rating virtually identical instances of behavior, more powerful techniques for estimating observer reliability are applicable, such as the intraclass correlation coefficient.

Since this study was concerned with the relation between attending behaviors and academic performance, as represented by an arithmetic computation task, it seems necessary to investigate the association as it relates to other subject matter areas and tasks. For example, what is the relation between attention and reading proficiency? Is attending, as defined in this study, an important variable when the child is engaged in a manipulative task such as a science experiment? Can important attending behaviors be exhibited in ways other than those described herein? All of these are important questions that are amenable to systematic investigation. Secondly, since causal relationships cannot be ascertained from the correlational methods used in this study, experimental investigations that manipulate attending rates need to be performed. Some studies of this type have been attempted (Becker, Madsen, Arnold, & Thomas, 1967; Bushell, Wrobel, & Michaelis, 1968; Hall, et al., 1968) but more work remains. Finally, the technique used in this study is highly applicable to the "field" type studies carried out in the area of child development. Experimenters employing variables like aggression, dependency, imitation, etc. which are conducted in natural settings such as nursery school playgrounds should find the technique extremely useful in the observation and recording of child behavior.

References

Adams, R. S. & Biddle, B. J. *Realities of teaching: Explorations with video tape.* New York: Holt, Rinehart and Winston, 1970.

Attwell, A. A., Orpet, R. E., & M[illegible], C. [illegible]. Kindergarten behavior ratings as a predictor of academic achievement. *Journal of School Psychology*, 1967, *6*, 43-46.

Becker, W. C., Madsen, C. H., Arnold, C. R., & Thomas, D. R. The contingent use of teacher attention and praise in reducing classroom behavior problems. *The Journal of Special Education*, 1967, *1*, 287-307.

Bushell, D., Wrobel, P. A., & Michaelis, M. L. Applying "group" contingencies to the classroom study behavior of preschool children. *Journal of Applied Behavior Analysis*, 1968, *1*, 55-61.

Cobb, J. A. Relationship of discrete classroom behaviors to fourth-grade academic achievement. *Journal of Educational Psychology*, 1972, *63*, 74-80.

Eichology, R. E., O'Daffer, P. G., Brumfiel, C. F., & Shanks, M. E. *Elementary school mathematics: Book 4. Teacher's Edition.* Palo Alto: Addison-Wesley, 1964.

Ferritor, D. E., Buckholdt, D., Hamblin, R. L., & Smith, L. Effects of contingent reinforcement for attending behavior on work accomplished. Paper presented at meetings of American Educational Research Association, New York, 1971. (Abstract)

Flanders, N. A. The problems of observer training and reliability. In E. Amidon & J. Hough (Eds.), *Interaction analysis: Theory, research, and application.* Palo Alto: Addison-Wesley, 1967. Pp. 158-166.

Gassholt, M. Precision techniques in the management of teacher and child behaviors. *Exceptional Children*, 1970, October, 129-134.

Guilford, J. P. Fundamental statistics in psychology and education. New York: McGraw-Hill Book Co., 1965.

Hall, R. V., Lund, D., & Jackson, D. Effects of teacher attention on study behavior. Journal of Applied Behavior Analysis, 1968, 1, 1-12.

Kagan, J. Understanding children: Behavior, motives and thought. New York: Harcourt, Brace Jovanovich, Inc., 1971.

Lahaderne, H. M. Attitudinal and intellectual correlates of attention: A study of four sixth-grade classrooms. Journal of Educational Psychology, 1968, 59, 320-324.

Lovitt, T. C. & Curtiss, K. A. Academic response rate as a function of teacher and self-imposed contingencies. Journal of Applied Behavior Analysis, 1969, 2, 49-53.